FOOD HABITS OF THE ROOF RAT (RATTUS RATTUS) IN TWO AREAS OF HAWAII VOLCANOES NATIONAL PARK

Christa A. Russell
Hawaii Volcanoes National Park
Hawaii 96718

INTRODUCTION

Previous food habit studies of the roof rat (Rattus rattus (L.)) in Hawai'i have dealt with rodents in sugar cane fields but not in forested areas. This investigation is part of a research program which was undertaken to determine the extents of the inimical factors which are endangering rare species in Hawai'i. The results of this research program will be published at a later date in a technical report of the Cooperative National Park Resources Studies Unit of the University of Hawaii (CPSU/UH).

The roof rat occurs in both wet and dry forests up to elevations of about 8000 feet in Hawaii Volcanoes National Park. It is a pest around human habitations but it is not dependent upon man for survival. The detrimental effects of the roof rat on native biota have not been well-documented. The roof rat has been noted as a predator upon native birds (Baldwin 1945; Munro 1945) and as a major destructive agent of vegetation (Korte 1963; Whitesell 1964).

METHODS

Collection of Rats

A total of 99 rats were collected with snap traps baited with peanut butter: 86 were collected in the montane rain forest and 13 were collected in the montane seasonal zone. The traps were set 15 to 20 m apart in five lines. The trap lines were 135 to 180 m in length. Identical trap lines and trap sites were not used when resampling.

A sample consisted of the rats caught from the five transects of traps set for three consecutive nights. The number of trap nights (trap night = number of traps x number of nights set) in the sample varied from a maximum of 150 to a minimum of 135 as a result of loss of traps or trap failure. Samples from the montane rain forest were taken monthly from April 1978 to April 1980, inclusive. Samples from the montane seasonal zone were taken monthly for six months from April 1979 to September 1979.

Stomach Analysis

The contents of each rat stomach were examined under a dissecting microscope. The food was finely masticated; therefore, identification was often difficult. Plant matter was divided into five groups: green plants, seeds, fruits and berries, fern rhizome, and moss. Using a reference collection of plant materials, the plant food groups were identified by trichomes, seed cases, flesh of berries, and size, shape, and color of particles. The animal matter was divided into four groups: arthropods, annelids, birds, and rodents. The arthropods were identified to class and, whenever possible, insects and insect larvae were identified to order. Birds were identified by the presence of feathers, and rodents were identified by the presence of flesh and bones.

Quantitative results were determined as a measure of the frequency at which the different items of food occurred in the stomach contents and are referred to later as frequency of occurrence expressed as a percentage of the total number of stomach contents examined for a sample.

RESULTS

In the montane rain forest samples green plants, seeds, and fruits and berries occurred at frequencies of 60%, 36%, and 22%, respectively. Arthropods occurred more frequently than any other animal food. Insects occurred in 32% of the stomachs examined, insect larvae occurred in 17% of the stomachs, and annelids occurred in 9% of the stomachs. One stomach contained the flesh and toe of a house mouse (Mus musculus Rutty). The feathers of an 'Apapane (Himatione sanguinea) were found in one stomach.

In the montane seasonal zone samples green plants occurred in all of the stomachs examined. Insect larvae occurred in over 80% of the stomachs. Insects and annelids occurred in 30%, and arachnids occurred in 7% of the stomachs. Seeds, fruits, and berries did not occur in any of the stomachs.

Seasonal variations in plant and animal matter were determined in the montane rain forest diet. Green plants occurred more frequently during the winter (Oct.-Mar.) than during the summer (Apr.-Sep.). Seeds, fruits, and berries occurred more frequently in summer than in winter. Fern rhizome and moss occurred in summer only. Insects and insect larvae occurred more frequently in winter. Annelids occurred more frequently in summer.

Variation of diet with habitat was examined. There was a significantly higher occurrence of green plants and arthropods in the montane seasonal zone diet. Seeds, fruits, and berries did not occur in the montane seasonal zone diet.

DISCUSSION

The roof rat in the montane rain forest and montane seasonal zone of Hawaii Volcanoes National Park utilizes a range of food types. These findings are consistent with Best (1969) for food habits of the roof rat in forest areas of New Zealand, and with Clark (1977) in the Galápagos Islands. The seasonal variation in diet suggests that in the montane rain forest the roof rat is not a selective feeder but uses those foods which are most abundant in the habitat.

The summer diet consisted of five types of plant foods while the winter diet consisted primarily of green plants. Arthropods and arthropod larvae presence increased during the winter while seeds, fruits and berries, and fern rhizome decreased during the winter.

The occurrence of green plants and arthropods was significantly higher in the montane seasonal zone diet. Insect larvae in particular contributed to the higher frequency at which arthropods occurred in the diet.

The roof rat is the most abundant rat species found in the montane rain forest and montane seasonal zone of Hawaii Volcanoes National Park (Russell, unpubl. data) and has extensively damaged several endemic plants. The endemic Cyrtandra platyphylla Gray; Broussaisia arguta Gaud.; and Clermontia hawaiiensis (Hbd.) Rock occurred only rarely in the collecting sites and no evidence of these plants was found in the stomach analyses. The author has observed rat damage to the flowers, fruits, and bark of the endemic Hibiscadelphus sp. and to the bark of olopua (Osmanthus sandwicensis (A. Gray) B. & H.); koa (Acacia koa Gray); and pilo (Coprosma rhynchocarpa Gray). In many instances rats will strip enough of the cambium layer to kill branches or limbs. Rat damage to the fruits of Pittosporum hosmeri Rock and sandalwood (Santalum paniculatum H. & A.) has also been observed.

Birds are not an important food in either habitat. In stomach analyses, birds occurred at a frequency of 1% and it was not known if the bird was killed by the rat or died of other causes. It is thought that one of the reasons for the decline of native forest birds in Hawai'i was the introduction of the roof rat, along with other exotic animals. Atkinson (1977) hypothesized that the spread of the roof rat throughout the Hawaiian Islands resulted in a stepwise accelerated decline of forest birds on each island. Native birds may have been more important in the diet as they were more numerous when the roof rat was becoming established in these habitats. The roof rat may indirectly contribute to the present decline of native forest birds through competition for food types which both animals utilize. An evaluation of this hypothesis is not possible from the present study.

LITERATURE CITED

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